AMENDMENTS TO THE CLAIMS:

The listing of claims below will replace all prior versions and listings of claims in the application:

Listing of Claims:

1. (Currently Amended) A method for timing misalignment determination in a radio receiver, comprising the steps of:

~~estimating and~~ correcting a frequency offset and determining a ~~establishing a time reference wherein the~~ boundary between ~~the~~a short[[-]] and long[[-]] preamble ~~is sufficient~~ in a received radio signal;

constructing a real signal from a complex time-domain signal associated with said short preamble;

extracting an n-sample sequence from a portion of said short preamble to obtain a plurality of equidistant equal amplitude frequency peaks wherein n is an integer greater than or equal to zero; and

determining a timing offset estimate by inspecting the relative phases of said plurality of equidistant equal amplitude frequency peaks~~;~~

~~wherein, data encoded in said received radio signal may thereafter be demodulated~~.

2. (Currently Amended) The method of Claim 1, wherein:

the step of constructing includes in-phase and quadrature-phase sampling of said received radio signal to obtain a real part and an imaginary part;

wherein said real and imaginary parts are similar to one another except for a fixed time-skew between them.

3. (Original) The method of Claim 2, wherein:

the step of constructing includes a simple addition of said real and imaginary parts to obtain said real signal.

4. (Currently Amended) The method of Claim 1, wherein:

the step of determining is such that the phase of a set of three frequency peaks Φ_1, Φ_2 and Φ_3 is assumed to vary with timing misalignment between $\Delta(t)$ and $\delta(t)$, and an intra-baud timing offset τ ~~can be~~is derived from Φ_1, Φ_2 and Φ_3 wherein, a received signal ~~can be~~is represented by,

$$\Psi(t) = \Phi_1(t) + 2\Phi_2(t) + \Phi_3(t)$$

$$= \frac{\pi}{4}\left(1 + \frac{t}{T_s}\right) + 2\frac{\pi}{4}\left(1 + 2\frac{t}{T_s}\right) + 3\frac{\pi}{4}\left(-1 + 2\frac{t}{T_s}\right)$$

$$= 2\pi\frac{t}{T_s}$$

and, $\Psi = (X_8 P_1)(X_{16} P_2)^2 (X_{24} P_3)$, where X_k and P_n respectively designate 64-point fast Fourier transform frequency components and the phase correcting coefficients needed to compensate for phase offset errors caused by a misalignment between $\Delta(t)$ and $\delta(t)$, and the timing misalignment τ is expressed as a fraction of a sampling period, T_s, and is

$$\tau = \frac{\Psi}{\pi}.$$

5. (Original) The method of Claim 1, wherein:

the step of determining computes a 64-point fast Fourier transform rather than a three-point discrete Fourier transform.

6. (Currently Amended) A method for timing misalignment determination in a radio receiver, comprising the steps of:

determining a boundary between a short preamble and a long preamble in a received radio signal;

linearly combining samples of two long sequences from said long preamble to obtain an idealized sequence of samples that best approaches under a certain criterion an ideal sequence of samples;

computing a normalized dot product of said idealized sequence of samples and an ideal on-baud sampled sequence to obtain a magnitude estimate of any timing misalignment; and

computing a dot product of said idealized sequence of samples and the time derivative of the ideal on-baud sampled sequence mentioned above to obtain a sign of any timing misalignment~~;~~

~~wherein data encoded in said received radio signal may thereafter be corrected for timing misalignment and then demodulated~~.

7. (Currently Amended) The method of Claim 6, wherein the steps of linearly combining and computing ~~can~~ use a cost function ~~can be used, and~~ mathematically described by,

$$C(\alpha_1,\alpha_2)=\left\|\vec{R}_{on}-\begin{bmatrix}X_1 & X_2\end{bmatrix}\begin{bmatrix}\alpha_1\\ \alpha_2\end{bmatrix}\right\|^2$$

$$=\left(\vec{R}_{on}-\begin{bmatrix}\vec{X}_1 & \vec{X}_2\end{bmatrix}\begin{bmatrix}\alpha_1\\ \alpha_2\end{bmatrix}\right)^H\left(\vec{R}_{on}-\begin{bmatrix}\vec{X}_1 & \vec{X}_2\end{bmatrix}\begin{bmatrix}\alpha_1\\ \alpha_2\end{bmatrix}\right)$$

$$=\left(\vec{R}_{on}^H-\alpha_1^*\vec{X}_1^H-\alpha_2^*\vec{X}_2^H\right)\left(\vec{R}_{on}-\alpha_1\vec{X}_1-\alpha_2\vec{X}_2\right)$$

$$=\left\|\vec{R}_{on}\right\|^2-2\,\mathrm{Re}\left(\alpha_1^*\vec{X}_1^H\vec{R}_{on}\right)-2\,\mathrm{Re}\left(\alpha_2^*\vec{X}_2^H\vec{R}_{on}\right)+2\,\mathrm{Re}\left(\alpha_1^*\alpha_2\vec{X}_1^H\vec{X}_2\right)+\left|\alpha_1\right|^2\left\|\vec{X}_1\right\|^2+\left|\alpha_2\right|^2\left\|\vec{X}_2\right\|^2$$

where,

$\vec{X}_1=\vec{C}_1\cdot\times\vec{R}_{off}+\vec{N}_1$ is the first sequence of the long preamble,

$\vec{X}_2=\vec{C}_2\cdot\times\vec{R}_{off}+\vec{N}_2$ is the second one,

$\vec{R}_{on}$ and $\vec{R}_{off}$ respectively designate the on - baud and off – baud sampled reference sequence, α_1 and α_2 are the weighting coefficients,

$$\vec{C}_1 = \begin{vmatrix} e^{j\varphi_1} \\ e^{j2\pi\frac{v}{F_s}+j\varphi_1} \\ \vdots \\ e^{j2\pi\frac{v}{F_s}63+j\varphi_1} \end{vmatrix},$$

$$\vec{C}_2 = \begin{vmatrix} e^{j\varphi_2} \\ e^{j2\pi\frac{v}{F_s}+j\varphi_2} \\ \vdots \\ e^{j2\pi\frac{v}{F_s}63+j\varphi_2} \end{vmatrix}, \text{ and}$$

v designates the frequency offset.

and, minimizing $C(\alpha_1, \alpha_2)$ with respect to α_1 and α_2 yields,

$$\frac{\partial C}{\partial \alpha_1} = -\vec{R}_{on}^H \vec{X}_1 + \alpha_2^* \vec{X}_2^H \vec{X}_1 + \alpha_1^* \left\|\vec{X}_1\right\|^2$$

$$= \sum_{n=0}^{63} R_{on}^*(n) R_{off}(n) e^{j2\pi\frac{v}{F_s}n+j\varphi_1} + \alpha_2^* e^{j(\varphi_1-\varphi_2)} \sum_{n=0}^{63} \left|R_{off}(n)\right|^2 + \alpha_1^* \left(\left\|\vec{R}_{off}\right\|^2 + \sigma_N^2\right)$$

$$= -e^{j\varphi_1} P + \alpha_1^* \left(S + \sigma_N^2\right) + \alpha_2^* e^{j(\varphi_1-\varphi_2)} S$$

$$\frac{\partial C}{\partial \alpha_2} = -\vec{R}_{on}^H \vec{X}_2 + \alpha_1^* \vec{X}_1^H \vec{X}_2 + \alpha_2^* \left\|\vec{X}_2\right\|^2$$

$$= -\sum_{n=0}^{63} R_{on}^*(n) R_{off}(n) e^{j2\pi\frac{v}{F_s}n+j\varphi_2} + \alpha_1^* e^{j(\varphi_2-\varphi_1)} \sum_{n=0}^{63} \left|R_{off}(n)\right|^2 + \alpha_2^* \left(\left\|\vec{R}_{off}\right\|^2 + \sigma_N^2\right)$$

$$= -e^{j\varphi_2} P + \alpha_1^* e^{j(\varphi_2-\varphi_1)} S + \alpha_2^* \left(S + \sigma_N^2\right)$$

with: $\sigma_N^2 = \vec{N}_1^H \vec{N}_1 = \vec{N}_2^H \vec{N}_2$, $S = \sum_{n=0}^{63} \left| R_{off}(n) \right|^2$ and $P = \sum_{n=0}^{63} R_{on}^*(n) R_{off}(n) e^{-j2\pi \frac{v}{F_s} n}$.

8. (Original) The method of Claim 7, wherein the steps of linearly combining and computing assume that $\vec{N}_1^H \vec{N}_2 = \vec{N}_1^H \vec{X}_2 = \vec{N}_2^H \vec{X}_1 = \vec{N}_1^H R = \vec{N}_2^H R = 0$, although such is not exactly true in reality, and thereby reduces computer processing required; and continuing with,

$$\begin{cases} \dfrac{\partial C}{\partial \alpha_1} = 0 \\ \dfrac{\partial C}{\partial \alpha_2} = 0 \end{cases} \Rightarrow \begin{bmatrix} S + \sigma_N^2 & e^{j(\varphi_1 - \varphi_2)} S \\ e^{j(\varphi_2 - \varphi_1)} S & S + \sigma_N^2 \end{bmatrix} \begin{bmatrix} \alpha_1^* \\ \alpha_2^* \end{bmatrix} = \begin{bmatrix} e^{j\varphi_1} P \\ e^{j\varphi_2} P \end{bmatrix}$$

$$\Leftrightarrow \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} = \frac{1}{\left(S + \sigma_N^2\right)^2 - S^2} \begin{bmatrix} S + \sigma_N^2 & -e^{j(\varphi_2 - \varphi_1)} S \\ -e^{j(\varphi_1 - \varphi_2)} S & S + \sigma_N^2 \end{bmatrix} \begin{bmatrix} e^{-j\varphi_1} P^* \\ e^{-j\varphi_2} P^* \end{bmatrix}$$

$$= \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} = \frac{P^*}{2S + \sigma_N^2} \begin{bmatrix} e^{-j\varphi_1} \\ e^{-j\varphi_2} \end{bmatrix}$$

in the absence of any timing misalignment, frequency offset or Gaussian noise, the weighting coefficients are simply, $\begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} = \frac{1}{2} \begin{bmatrix} e^{-j\varphi_1} \\ e^{-j\varphi_2} \end{bmatrix}$.

9. (Original) The method of Claim 8, wherein the steps of linearly combining and computing produce an $\Gamma(v)$ that is real and much greater than $\left| R_{on}(0)^2 \right|$, and the result is

$\angle P_{on}^{*} \cong -2\pi \frac{V}{F_s} 32$ radian, and wherein, P^{*} is composed of two phase coefficients, a first one (P_{on}^{*}) centers the frequency offset related phase component around $Z(32)$, and the second one (P_{Δ}^{*}) contains timing-misalignment information.

10. (Original) The method of Claim 9, wherein the steps of linearly combining and computing find $\vec{Z}$, and determine the absolute value and sign of the timing misalignment by computing dot products, as in,

$$\gamma_{value} = \frac{\left|\vec{Z}^{H}\vec{R}_{on}\right|}{\left\|\vec{R}_{on}\right\|^{2}} \frac{\lambda_{\max}}{\lambda_{\max} - \lambda_{\min}}$$

where: $\{\lambda_{\max}, \lambda_{\min}\} = eig(M^{H}M)$ with $M = [\vec{X}_1 \quad \vec{X}_2]$, and

$$\lambda_{sign} = \mathrm{Re}\left(\vec{Z}^{H} \frac{\partial \vec{R}_{on}}{\partial t}\right).$$